(12) UK Patent (19) GB (11) 2 272 616 (13) B

(54) Title of Invention

Teletext receivers

(51) INT CL[6]; **H04N 7/087**

(21) Application No
9223633.0

(22) Date of filing
11.11.1992

(43) Application published
18.05.1994

(45) Patent published
04.09.1996

(72) Inventor(s)
Edwin Paul Tozer

(73) Proprietor(s)
Sony United Kingdom Limited

(Incorporated in the United Kingdom)

The Heights
Brooklands
Weybridge
Surrey
KT13 0XW
United Kingdom

(74) Agent and/or Address for Service
D Young & Co
21 New Fetter Lane
London
EC4A 1DA
United Kingdom

(52) Domestic classification (Edition O)
H4T TDAA T121

(56) Documents cited
EP0379252 A
EP0190837 A
US4991017 A

(58) Field of search

As for published application 2272616 A *viz:*
UK CL(Edition L) **H4T TDAA**
INT CL[5] **H04N 7/00 7/087**
Online databases: WPI Inspec
updated as appropriate

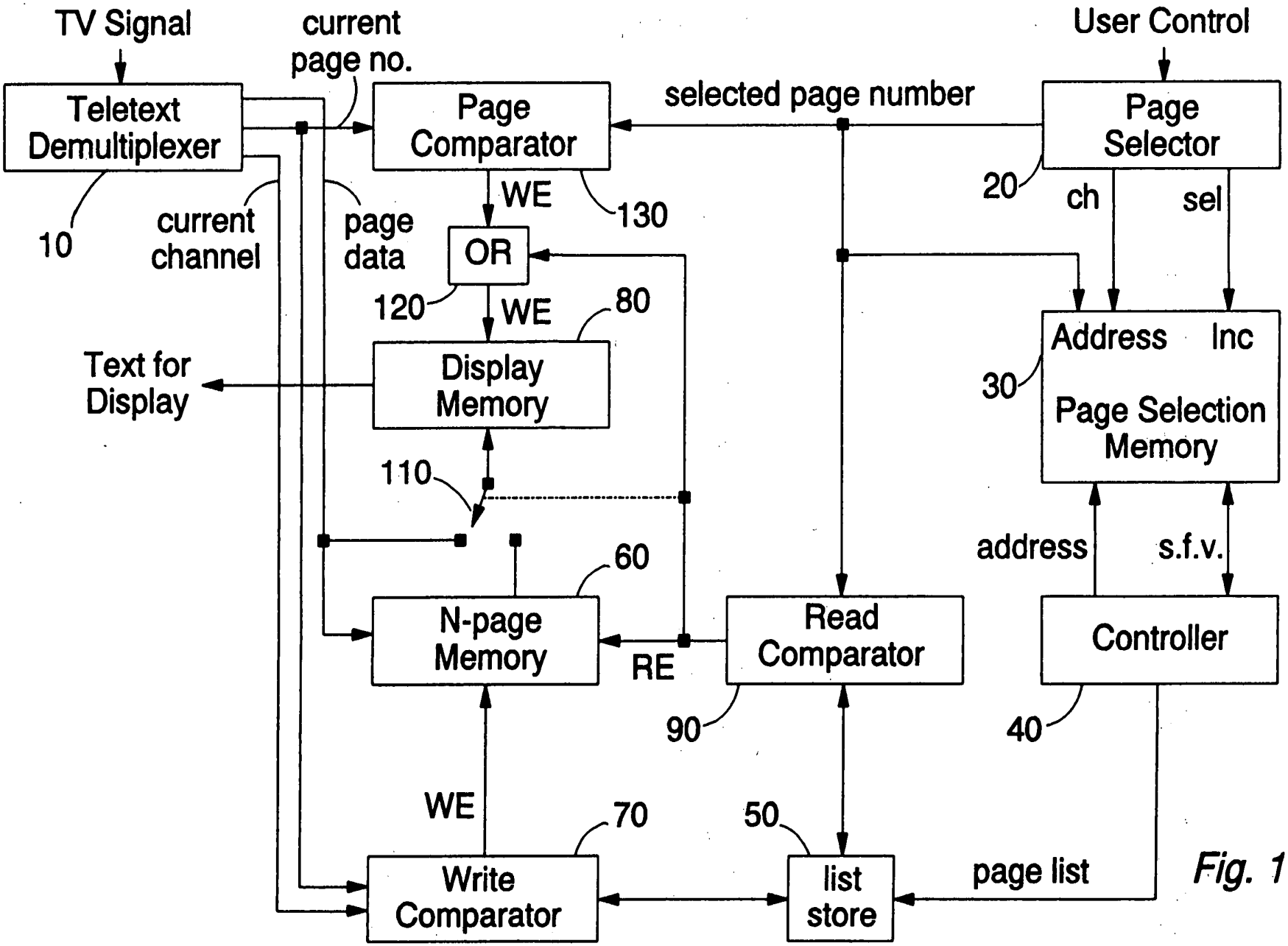
TV Signal
current page no.
User Control
Teletext Demultiplexer
Page Comparator
selected page number
Page Selector
10
current channel
page data
WE
130
20
ch
sel
OR
120
WE
80
Address
Inc
Text for Display
Display Memory
30
Page Selection Memory
110
address
s.f.v.
60
N-page Memory
RE
Read Comparator
Controller
90
40
WE
70
50
Write Comparator
list store
page list

Fig. 1

1/2

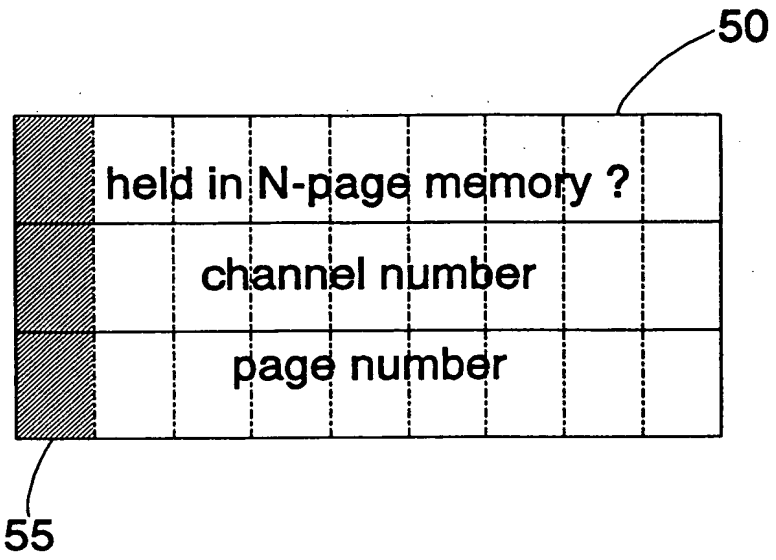
50
held in N-page memory ?
channel number
page number
55

Fig 2.

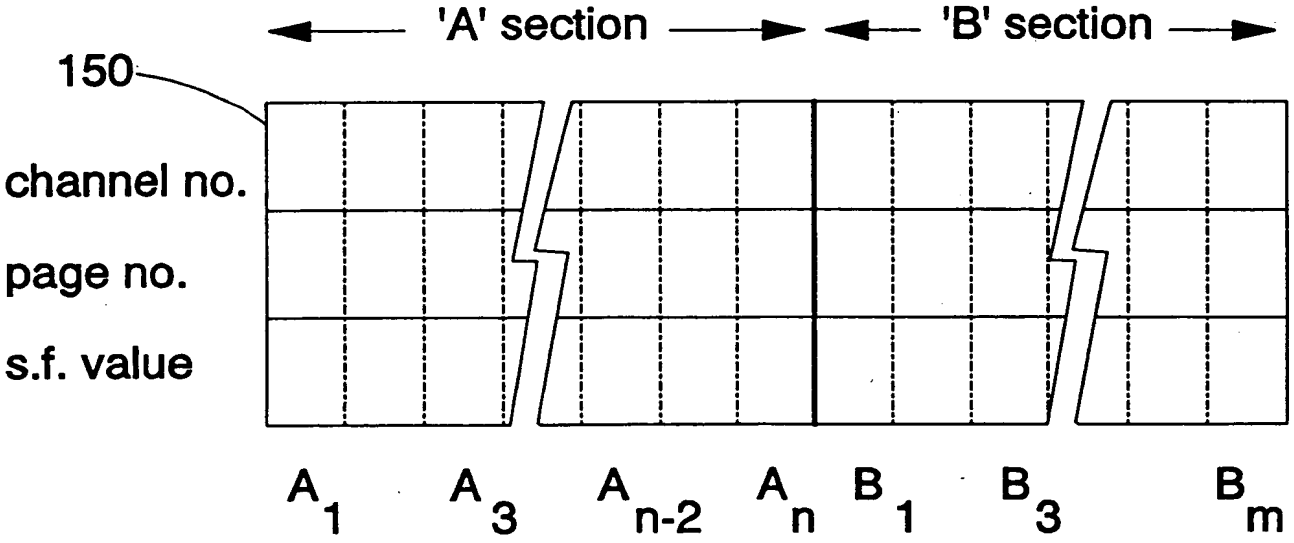
'A' section
'B' section
150
channel no.
page no.
s.f. value
A 1
A 3
A n-2
A n
B 1
B 3
B m

Fig 3.

TELETEXT RECEIVERS

This invention relates to teletext receivers.

Teletext data, comprising character and graphical control codes, are transmitted during video lines of the vertical (or field) blanking interval (VBI) of a broadcast television signal. In teletext systems used in the United Kingdom and several other countries the data are arranged as successive pages, each page comprising 24 rows of 40 characters of text. Teletext receivers demultiplex the teletext data from the television signal and, in response to selection by a user, display selected pages.

Only a limited number of video lines are available in the VBI for transmitting teletext data. For example, in the phase alternating line (PAL) transmission standard used in the United Kingdom, lines 11 to 18 (in even fields) and lines 324 to 331 (in odd fields) are reserved for teletext use. Five synchronising symbols and 40 characters (i.e. one row of a teletext page) are digitally transmitted during the active line period of each teletext line, so that a complete teletext page of 1 "header" row and 24 text rows takes about 3 video fields (0.06 seconds) to transmit.

A typical teletext service associated with a television channel may comprise several hundred teletext pages, which are transmitted in a cyclic sequence having a period of, say, 20 seconds. This means that when a particular page is selected by a user, that page cannot be displayed until it is next transmitted in the cyclic sequence. This imposes a delay between the selection and display of a page, with the length of the delay depending on the point in the cyclic sequence at which the page selection is made.

One proposed way of helping to reduce the delay between page selection and display is the so-called "Fastext" system, in which each page is transmitted with associated pointers indicative of four other pages commonly selected by users after reading that page. A Fastext receiver detects the four pointers and demultiplexes and stores the four other pages, for instant display should those pages then be selected by the user. However, if the user selects a different page, that page must be accessed conventionally, with an associated time delay between selection and display.

This invention provides a teletext receiver in which teletext pages demultiplexed from a video signal are displayed in response to user selection of corresponding page identifiers, the receiver comprising:

means for storing information indicative of the relative frequency of user selection of the page identifiers;

selection frequency detecting means for detecting a predetermined number of most frequently selected page identifiers;

a page memory for storing teletext pages corresponding to the most frequently selected page identifiers; and

means, responsive to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, for retrieving that teletext page from the page memory for display;

the means for storing comprising:

a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier;

means, responsive to user selection of a page identifier stored in an entry in the first memory section or the second memory section, for incrementing the selection frequency value associated with the selected page identifier;

means, responsive to user selection of a page identifier not stored in an entry in the first memory section or the second memory section, for storing that page identifier in an entry in the second memory section, overwriting the least recently stored page identifier in the second memory section; and

means, responsive to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, for exchanging that entry in the first memory section with that entry in the second memory section.

The invention solves, or at least alleviates, the problem of a time delay between page selection and display, by providing a teletext receiver having a page memory operable to store a predetermined number of pages which are most frequently selected by the user of that particular teletext receiver. This contrasts with, for example, the Fastext system which relies on page selection frequencies appropriate

to all of the users of a particular teletext service.

The selection frequency values stored in the means for storing can be used efficiently by an embodiment in which the selection frequency detecting means is operable to detect the predetermined number of highest selection frequency values stored in the means for storing.

Although the means for storing could be arranged so that the maximum selection frequency value which can be stored is large enough to allow for teletext page selection during the entire life of the teletext receiver, this can make the means for storing very slow to react to a change in the page selection habits of the user (e.g. when the receiver is sold or transferred to a new user). It is therefore preferable to employ means for detecting whether one or more of the selection frequency values is equal to a predetermined maximum value; and means, responsive to a detection that one or more of the selection frequency values is equal to the maximum value, for decrementing at least some of the selection frequency values. The predetermined maximum value may be selected so that the means for storing responds reasonably quickly as described above, without responding to spurious page selections.

Preferably the means for decrementing comprises means for decrementing all of the selection frequency values stored in the means for storing. However, in order that small selection frequency values can accumulate even when other selection frequency values reach the maximum value, in another preferred embodiment the means for decrementing comprises means for decrementing those selection frequency values stored in the means for storing which are within a predetermined range of the maximum value.

In order that the means for retrieving can detect when a teletext page identified in the list has been stored in the page memory, it is preferred that the receiver comprises means for storing a list comprising the predetermined number of most frequently selected page identifiers and respective storage flags indicating whether the teletext page corresponding to each page identifier in the list has been stored in the page memory. In this case it is preferred that the receiver comprises means for controlling storage in the page memory of a currently demultiplexed teletext page having a page identifier

identical to a page identifier in the list of page identifiers; and means for setting the storage flag associated with that page identifier to indicate that the currently demultiplexed teletext page has been stored in the page memory.

Although, for example, page numbers alone could be used as the page identifiers, it is preferred that each of the page identifiers comprises a page number and a television channel number (although the television channel number selected by the user may well remain constant for several successively selected page numbers). In this case, although the most frequently selected pages from any channel could be detected and stored, in order to use the page memory efficiently it is preferred that the selection frequency detecting means is operable to detect the predetermined number of most frequently selected page identifiers for a currently received television channel.

Viewed from a second aspect this invention provides a teletext decoder operable to receive teletext pages demultiplexed from a video signal and to output teletext pages for display in response to a user selection of corresponding page identifiers, the decoder comprising:

means for storing information indicative of the relative frequency of user selection of the page identifiers;

selection frequency detecting means for detecting a predetermined number of most frequently selected page identifiers;

a page memory for storing teletext pages corresponding to the most frequently selected page identifiers; and

means, responsive to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, operable to retrieve that teletext page from the page memory and to output that teletext page for display;

the means for storing comprising:

a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier;

means, responsive to user selection of a page identifier stored in an entry in the first memory section or the second memory section, for incrementing the selection frequency value associated with the selected page identifier;

means, responsive to user selection of a page identifier not stored in an entry in the first memory section or the second memory section, for storing that page identifier in an entry in the second memory section, overwriting the least recently stored page identifier in the second memory section; and

means, responsive to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, for exchanging that entry in the first memory section with that entry in the second memory section.

Viewed from a third aspect this invention provides a method of teletext reception, in which teletext pages demultiplexed from a video signal are displayed in response to a user selection of corresponding page identifiers, the method comprising the steps of:

storing, in a memory having a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier, information indicative of the relative frequency of user selection of the page identifiers;

detecting a predetermined number of most frequently selected page identifiers;

storing teletext pages corresponding to the most frequently selected page identifiers;

detecting whether a teletext page corresponding to a page identifier selected by the user is stored in the page memory; and

in response to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, retrieving that teletext page from the page memory for display;

the step of storing comprising:

in response to user selection of a page identifier stored in an entry in the first memory section or the second memory section, incrementing the selection frequency value associated with the selected page identifier;

in response to user selection of a page identifier not stored in an entry in the first memory section or the second memory section, storing that page identifier in an entry in the second memory section, to overwrite the least recently stored page identifier in the second memory section; and

in response to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, exchanging that entry in the first memory section with that entry in the second memory section.

The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Figure 1 is a schematic block diagram of a teletext receiver;

Figure 2 is a schematic diagram of a page list store; and

Figure 3 is a schematic diagram of a page selection memory.

Of the above Figures, Figure 2 is included as technical background and to provide a comparison with the embodiment of Figure 3.

Figure 1 is a schematic block diagram of a teletext receiver in which a teletext demultiplexer 10 receives a television (TV) signal and demultiplexes teletext information from that TV signal. At any time either (or both) of the demultiplexed teletext information and conventional picture information derived from the TV signal may be displayed by the teletext receiver.

As described above, teletext pages are received serially in video lines of the vertical blanking interval of the television signal. Each page takes about 0.06 seconds to transmit, and includes a page header row which specifies a page number associated with that page. The teletext demultiplexer 10 provides three output signals: a current channel identifier specifying the TV channel currently being received; a current teletext page number derived from the header row of the currently received page; and the serial teletext page data themselves.

A page selector 20 is responsive to user control (for example by means of a handset or remote commander) to output a page number selected by the user, a television channel number selected by the user (which may well be constant for several successive page numbers), and a selection signal indicating that a new page or channel selection has been made. The three outputs of the page selector 20 are supplied as inputs to a page selection memory 30, which stores the relative frequency of selection of the available teletext pages. The page selection memory 30 is a non-volatile random access memory (RAM) having a large number of address locations, each capable of storing a multi-

bit data word. A concatenation of the selected page number and the selected channel number forms a memory address at which a selection frequency value corresponding to that page number and channel number is stored. The page selection memory 30 comprises a sufficient number of address locations to store a selection frequency value for each possible page number and channel number combination. When a new page or channel selection is made (as indicated by the selection signal), the selection frequency value stored at the memory address corresponding to the newly selected page number and channel number is incremented. Because the page selection memory is non-volatile, the selection frequency values stored therein represent the relative frequencies of page selection made by the user over a period of time.

A controller 40 accesses the page selection memory 30 to determine the N most frequently selected page numbers. The controller 40 cycles through the addresses of the page selection memory 30 and detects the N highest selection frequency values. If one or more of the selection frequency values is at the maximum value which can be stored in the page selection memory 30 (e.g. for an 8-bit memory, the maximum selection frequency value would be 255), then all of the selection frequency values stored in the page selection memory are decremented. (As an alternative, only the selection frequency value which has reached the maximum value, or only those values within a certain range of the maximum value, need be decremented. This would allow small selection frequency values to accumulate even when other selection frequency values reach the maximum value).

The controller 40 outputs a page list comprising the N most frequently selected page number/channel number combinations. The page list is stored in a list store 50.

Teletext data representing the N most frequently selected pages, (i.e. the pages specified in the page list held in the list store 50) are stored in an N-page memory 60 under the control of a write comparator 70. The write comparator 70 receives the current page number and current channel from the teletext demultiplexer 10 and compares these values with the page list held in the list store 50. This comparison takes place in the time between the reception of the header row of each page (including the page number of that page) and the output by the teletext demultiplexer 10 of the teletext page data

for that page (a period of about 9 microseconds). If the current channel number and current page number match an entry in the page list, the write comparator sets a write enable ("WE") flag to control writing of the current page data into the N-page memory 60. The write comparator also sets a "stored" flag associated with that entry in the page list to indicate that the page data have been stored.

The list store 50 and the N-page memory 60 may comprise volatile or non-volatile memories. If non-volatile memories are used, then there will be page data stored for immediate access when the receiver is first switched on, although those data will relate to pages received when the receiver was last used.

Each teletext page comprises 24 rows of 40 characters of text, a total of 960 characters. This means that about one kilobyte (1024 bytes) of memory is sufficient to store a complete page along with any page identification data. The N-page memory 60 can thus be implemented as an N-kilobyte RAM.

Data representing a page to be displayed are stored in a display memory 80. In order to display a page selected by the user, either page data retrieved from the N-page memory 60 or currently received page data are written into the display memory 80, depending on whether the selected page is one of the N most frequently selected pages stored in the N-page memory 60. Reading from the display memory 80 is performed continually in accordance with the scanning of an output display device such as a cathode ray tube.

A read comparator 90 receives the selected page number from the page selector 20 and compares this with the entries in the list store 50. If that page number is held in the list store 50 and the "stored" flag associated with that page number is set (to indicate that the page has been stored in the N-page memory 60) the read comparator 90 sets a read enable ("RE") signal to control reading of that page from the N-page memory 60. The read enable signal also performs two other functions: it controls a switch 110 to select the output of the N-page memory 60 as a data input to the display memory 80, and it is supplied as an input to an OR-gate 120 to generate a write enable signal to control writing into the display memory 80.

If the selected page number is not held in the list store 50, or if the respective "stored" flag is not set (indicating that that page

has not yet been written into the N-page memory 60), then the read comparator controls the switch 110 to select the currently received page data as an input to the display memory 80. The writing of the currently received page data into the display memory 80 is controlled by a page comparator 130, which compares the selected page number with the current page number from the teletext demultiplexer 10. When the current page number matches the selected page number, the page comparator 130 generates a write enable (WE) signal which is passed to the display memory 80 via the OR-gate 120, to control writing of the current page data into the display memory 80.

Figure 2 is a schematic diagram of the list store 50. The list store 50 stores a number (N) of entries which are drawn schematically as columns 55. Each entry comprises a page number, a channel number and the "stored" flag indicating whether that page is stored in the N-page memory 60.

In an alternative embodiment the controller 40 selects the N most frequently selected pages from the current channel only. This is achieved by the controller varying only the page number when addressing the page selection memory 30. In this case, the list store 50 need only store entries comprising a page number and a "stored" flag. When a new channel is selected by the user, the controller 40 resets all of the "stored" flags in the list store.

The page selection memory 30 described with reference to Figure 1 comprises one address location for each possible page number and channel combination. However, if a large number of television channels are available (for example in a cable television system), each having a large number of teletext pages, then not only must the page selection memory 30 be large, but the controller 40 must cycle through a large number of entries to determine the N most frequently selected pages for use as the page list. An alternative design of the page selection memory, requiring a smaller number of address locations, is illustrated at 150 in Figure 3. In Figure 3, each memory location is arranged to store a channel number and a page number, along with the selection frequency value for that channel number and page number combination. The page selection memory 150 comprises an "A" section, having address locations A_1 to A_n, and an "B" section having address locations B_1 to B_m. The total number of entries in the page selection memory 150, i.e. n+m,

is chosen to be larger than the number of different pages normally accessed by a typical user.

When a new teletext page is selected, if that page number and channel number already exist in either the A section or the B section of the page selection memory 150, then the selection frequency value at that location is incremented. However, if the page number and channel number combination do not exist in the page selection memory then the data stored in the location B_m are discarded, the data stored at location B_{m-1} are moved to location B_m, the data stored at the location B_{m-2} are moved to the location B_{m-1} and so on, until the newly selected page number and channel number combination may be written to the free location B_1. In this way the newly selected page number and channel number overwrite the least recently written page number and channel number combination in the B section of the page selection memory 150.

Whenever the controller 40 detects that a location in the B section of the page selection memory 150 has a higher selection frequency value than an entry in the A section, those two entries are swapped over. If any of the selection frequency values reaches the maximum value which can be stored in the page selection memory 150, then the controller 40 decrements some or all of the selection frequency values stored in the A section.

The page selection memory 150 requires significantly less storage space than the page selection memory 30, whilst still allowing page numbers which have not previously been selected by the user to gain a place in the list of most frequently selected pages.

While the invention has been described with reference to the teletext receiver shown in Figure 1, the invention could equally be embodied as a teletext decoder operable to receive teletext data already demultiplexed from a video signal. Also, although a hardware implementation of the invention has been described, other embodiments may comprise a general purpose data processing apparatus operating under the control of suitable computer software.

CLAIMS

1. A teletext receiver in which teletext pages demultiplexed from a video signal are displayed in response to user selection of corresponding page identifiers, the receiver comprising:

means for storing information indicative of the relative frequency of user selection of the page identifiers;

selection frequency detecting means for detecting a predetermined number of most frequently selected page identifiers;

a page memory for storing teletext pages corresponding to the most frequently selected page identifiers; and

means, responsive to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, for retrieving that teletext page from the page memory for display;

the means for storing comprising:

a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier;

means, responsive to user selection of a page identifier stored in an entry in the first memory section or the second memory section, for incrementing the selection frequency value associated with the selected page identifier;

means, responsive to user selection of a page identifier not stored in an entry in the first memory section or the second memory section, for storing that page identifier in an entry in the second memory section, overwriting the least recently stored page identifier in the second memory section; and

means, responsive to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, for exchanging that entry in the first memory section with that entry in the second memory section.

2. A receiver according to claim 1, in which the selection frequency detecting means is operable to detect the predetermined number of highest selection frequency values stored in the means for storing.

3. A receiver according to claim 1 or claim 2, comprising:

means for detecting whether one or more of the selection frequency values is equal to a predetermined maximum value; and

means, responsive to a detection that one or more of the selection frequency values is equal to the maximum value, for decrementing at least some of the selection frequency values.

4. A receiver according to claim 3, in which the means for decrementing comprises means for decrementing all of the selection frequency values stored in the means for storing.

5. A receiver according to claim 3, in which the means for decrementing comprises means for decrementing those selection frequency values stored in the means for storing which are within a predetermined range of the maximum value.

6. A receiver according to any one of the preceding claims, comprising means for storing a list comprising the predetermined number of most frequently selected page identifiers and respective storage flags indicating whether the teletext page corresponding to each page identifier in the list has been stored in the page memory.

7. A receiver according to claim 6, comprising:

means for controlling storage in the page memory of a currently demultiplexed teletext page having a page identifier identical to a page identifier in the list of page identifiers; and

means for setting the storage flag associated with that page identifier to indicate that the currently demultiplexed teletext page has been stored in the page memory.

8. A receiver according to any one of the preceding claims, in which each of the page identifiers comprises a page number and a television channel number.

9. A receiver according to claim 10, in which the selection frequency detecting means is operable to detect the predetermined number of most frequently selected page identifiers for a currently

received television channel.

10. A teletext decoder operable to receive teletext pages demultiplexed from a video signal and to output teletext pages for display in response to a user selection of corresponding page identifiers, the decoder comprising:

means for storing information indicative of the relative frequency of user selection of the page identifiers;

selection frequency detecting means for detecting a predetermined number of most frequently selected page identifiers;

a page memory for storing teletext pages corresponding to the most frequently selected page identifiers; and

means, responsive to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, operable to retrieve that teletext page from the page memory and to output that teletext page for display;

the means for storing comprising:

a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier;

means, responsive to user selection of a page identifier stored in an entry in the first memory section or the second memory section, for incrementing the selection frequency value associated with the selected page identifier;

means, responsive to user selection of a page identifier not stored in an entry in the first memory section or the second memory section, for storing that page identifier in an entry in the second memory section, overwriting the least recently stored page identifier in the second memory section; and

means, responsive to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, for exchanging that entry in the first memory section with that entry in the second memory section.

11. A method of teletext reception, in which teletext pages demultiplexed from a video signal are displayed in response to a user

selection of corresponding page identifiers, the method comprising the steps of:

storing, in a memory having a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier, information indicative of the relative frequency of user selection of the page identifiers;

detecting a predetermined number of most frequently selected page identifiers;

storing teletext pages corresponding to the most frequently selected page identifiers;

detecting whether a teletext page corresponding to a page identifier selected by the user is stored in the page memory; and

in response to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, retrieving that teletext page from the page memory for display;

the step of storing comprising:

in response to user selection of a page identifier stored in an entry in the first memory section or the second memory section, incrementing the selection frequency value associated with the selected page identifier;

in response to user selection of a page identifier not stored in an entry in the first memory section or the second memory section, storing that page identifier in an entry in the second memory section, to overwirte the least recently stored page identifier in the second memory section; and

in response to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, exchanging that entry in the first memory section with that entry in the second memory section.

12. A teletext receiver substantially as hereinbefore described with reference to Figures 1 and 3 of the accompanying drawings.

13. A teletext decoder substantially as hereinbefore described with reference to Figures 1 and 3 of the accompanying drawings.

14. A method of teletext reception substantially as hereinbefore described with reference to Figures 1 and 3 of the accompanying drawings.